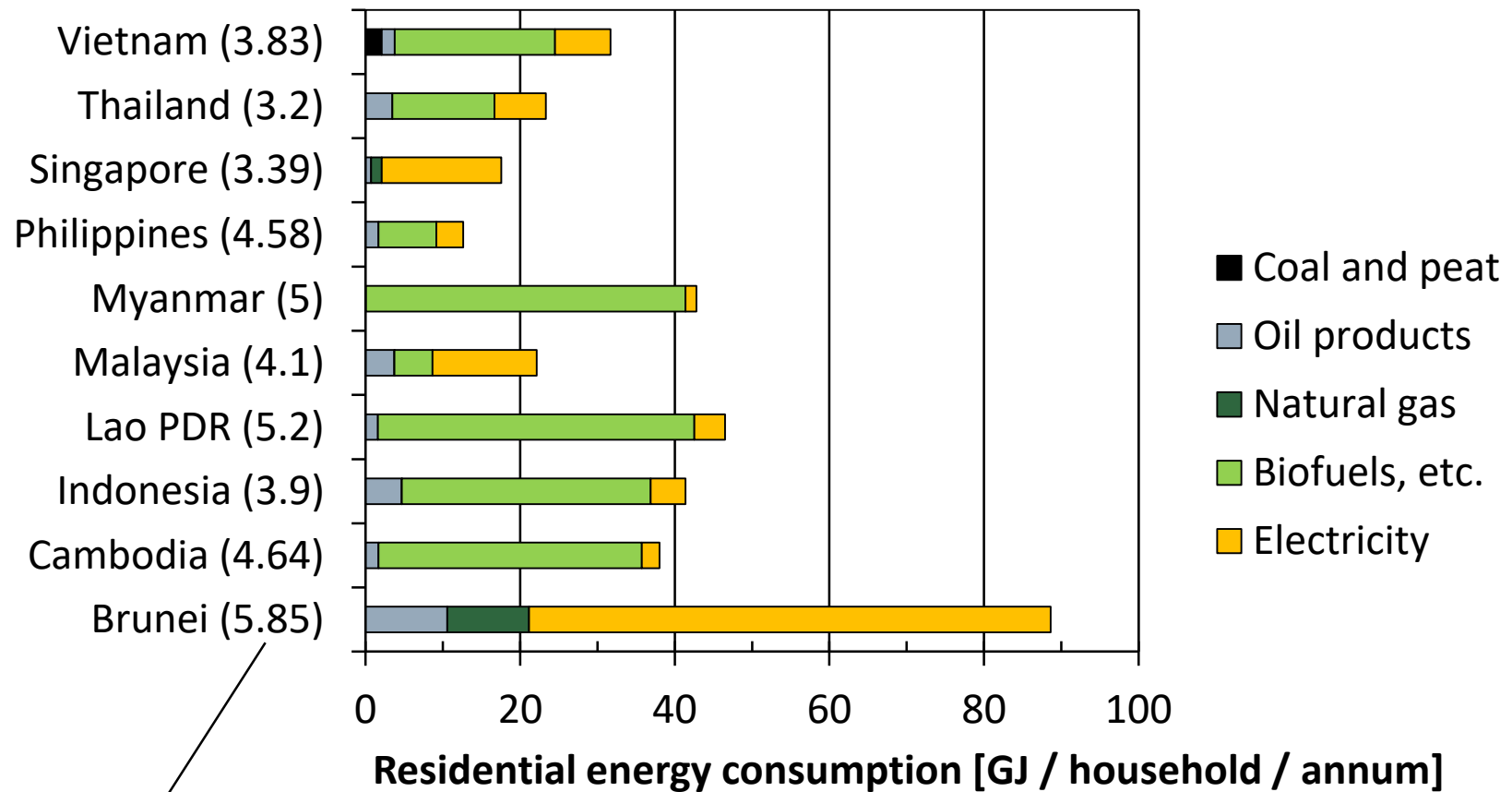


Steady Increase in Electricity in the ASEAN Residential Sector

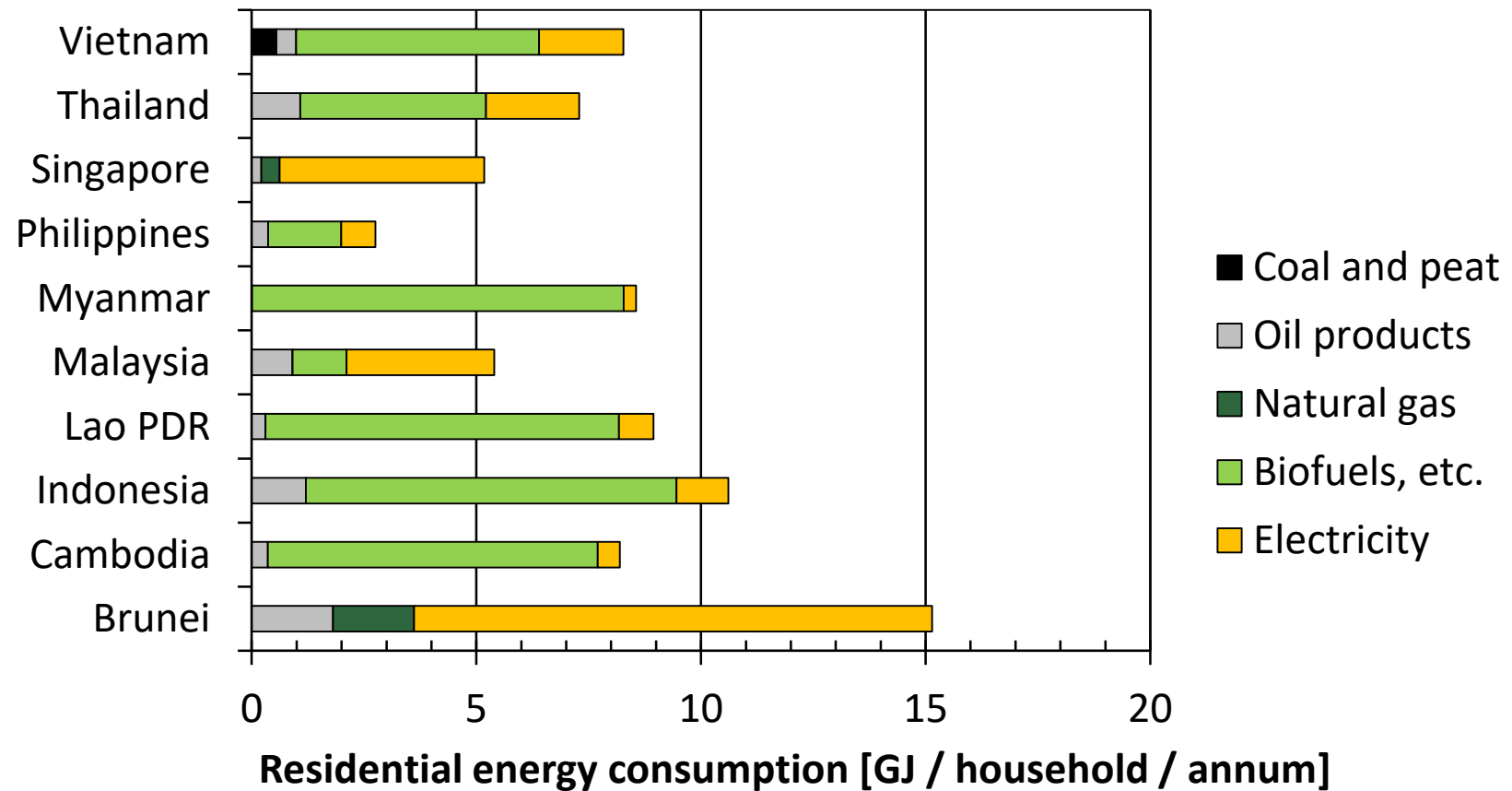
FUKUYO, YAMAGUCHI UNIV.

Residential energy consumption per household, 2014



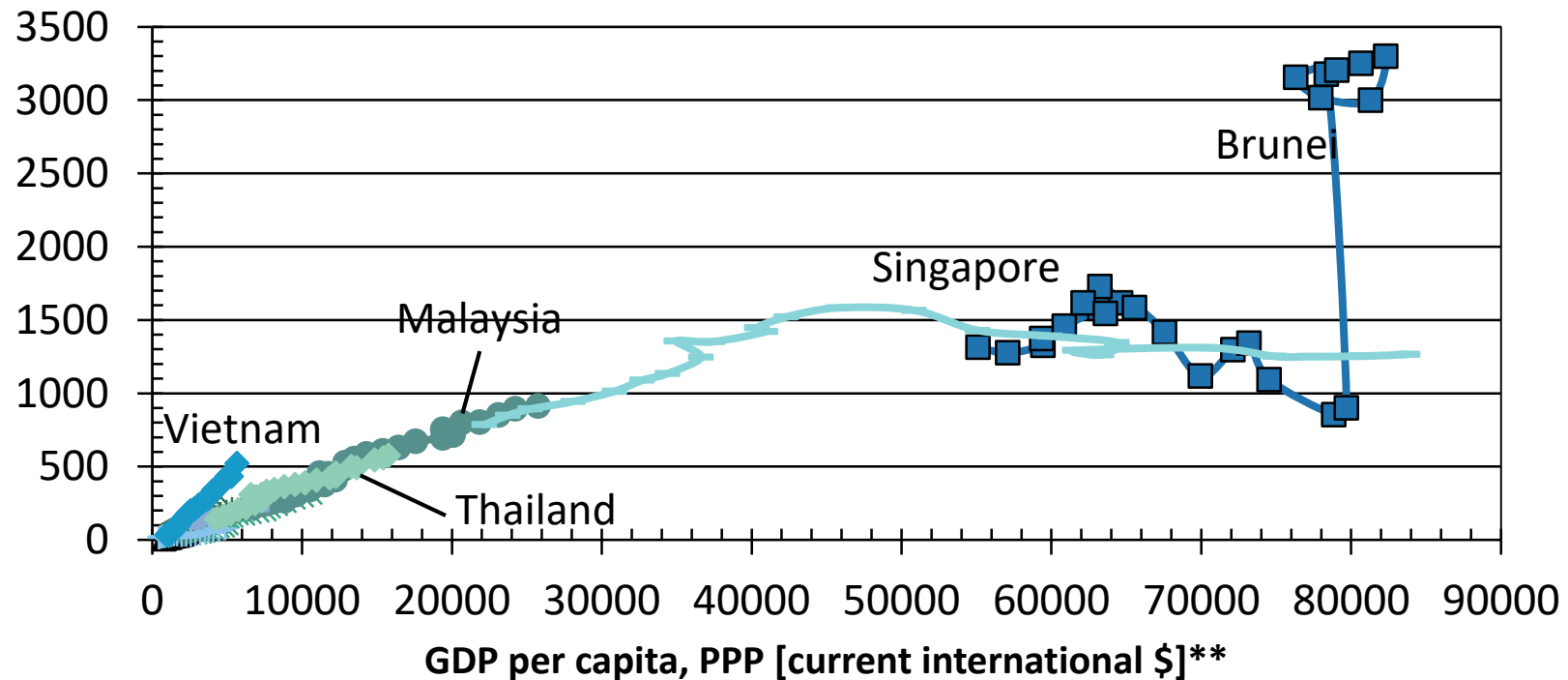
(average size of household)

Residential energy consumption per capita, 2014



Economic development and electricity consumption (a)

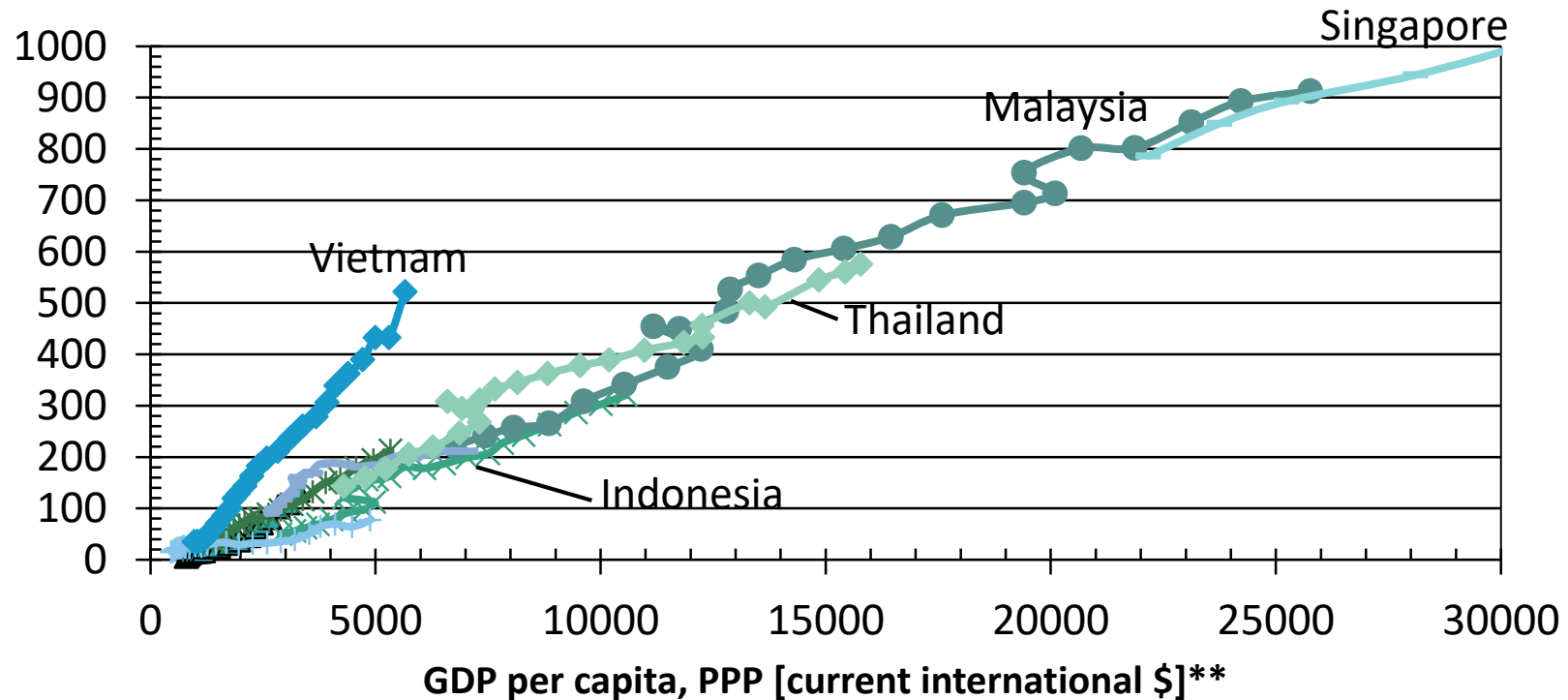
Yearly residential electricity consumption per capita*
[kWh / capita / annum]



Source: *IEA, EDL; **World Bank

Economic development and electricity consumption (b)

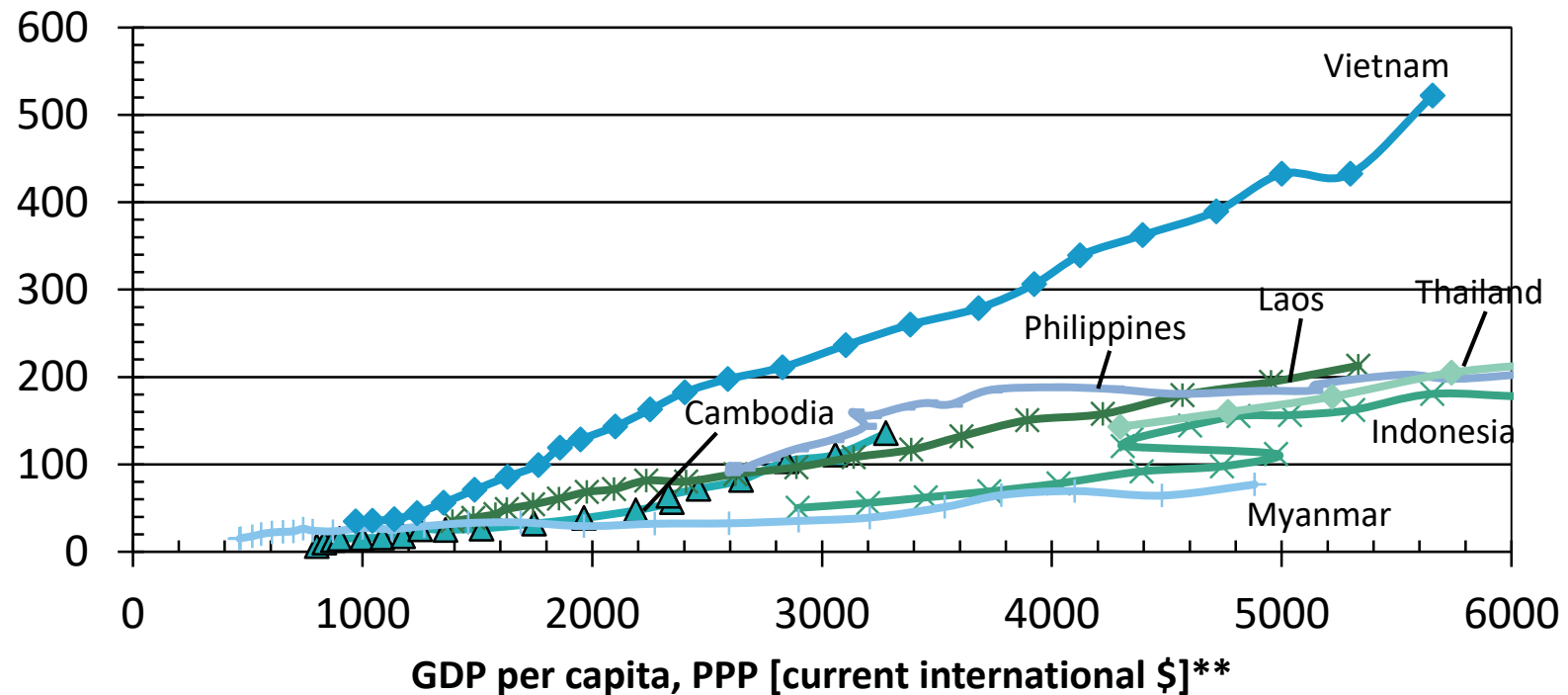
Yearly residential electricity consumption per capita*
[kWh / capita / annum]



Source: *IEA, EDL; **World Bank

Economic development and electricity consumption (c)

Yearly residential electricity consumption per capita*
[kWh / capita / annum]



Source: *IEA, EDL; **World Bank

Population and climate classification of the ASEAN large cities

City	Population	Climate
Bandar Seri Begawan (Brunei)	NA	Af (tropical rainforest)
Phnom Penh (Cambodia)	1,688,040 (2013 [4])	Aw (tropical savanna)
DKI Jakarta (Indonesia)	10,075,300 (2014 [5])	Am (tropical monsoon)
Vientiane Capital (Laos)	828,000 (2014 [6])	Aw (tropical savanna)
Kuala Lumpur (Malaysia)	1,780,400 (2014 [7])	Af (tropical rainforest)
Nay Pyi Taw (Myanmar)	1,197,000 (2015 [8])	Aw (tropical savanna)
Yangon (Myanmar)	7,595,000 (2015 [8])	Am (tropical monsoon)
NCR Manila (Philippines)	12,877,253 (2015 [9])	Aw (tropical savanna)
Singapore (Singapore)	5,535,002 (2015 [10])	Af (tropical rainforest)
Bangkok (Thailand)	8,305,218 (2010 [11])	Aw (tropical savanna)
Hanoi (Vietnam)	7,216,000 (2015 [12])	Cwa (humid subtropical)
Ho Chi Minh City (Vietnam)	8,146,300 (2015 [12])	Aw (tropical savanna)

Tropical climates are categorized into three climates by precipitation: tropical rainforest (indicated by Af under the Köppen climate classification), tropical monsoon (Am), and tropical savanna (Aw). Only Hanoi belongs to the subtropical climate (indicated by Cwa)

Energy consumption models

COBB-DOUGLAS PRODUCTION
FUNCTION, ENERGY-GROWTH NEXUS
MODEL

$$Y_t = AK_t^{\alpha_1} L_t^{\alpha_2} E_t^{\alpha_3}$$

Where

Y: real GDP

A: technology

K: capital

L: labor/population

E: energy consumption

t: year

TOP DOWN (EOM-CLARKE-KIM-KYLE-
PATEL) MODEL, RESIDENTIAL SECTOR

$$E_t = k_1 \{1 - \exp(-k_2 I_t)\}$$

Where

E_t : per capita residential electricity
consumption at the t -year

I_t : the per capita income at the t -year

k_1 : asymptotic value of E_t

k_2 : parameter that depends by the
electricity price and saturation
impedance of electricity service

Energy consumption models for residential sector

TOP DOWN (LOGISTIC) MODEL

$$E_t = \frac{a}{\{1 + \exp(\frac{b - Y_t}{c})\}}$$

Where

E_t : per capita residential electricity consumption at the t -year

Y_t : the per capita GDP at the t -year

a : asymptotic value of E_t

b, c : parameter

TOP DOWN (EOM-CLARKE-KIM-KYLE-PATEL) MODEL

$$E_t = k_1 \{1 - \exp(-k_2 I_t)\}$$

Where

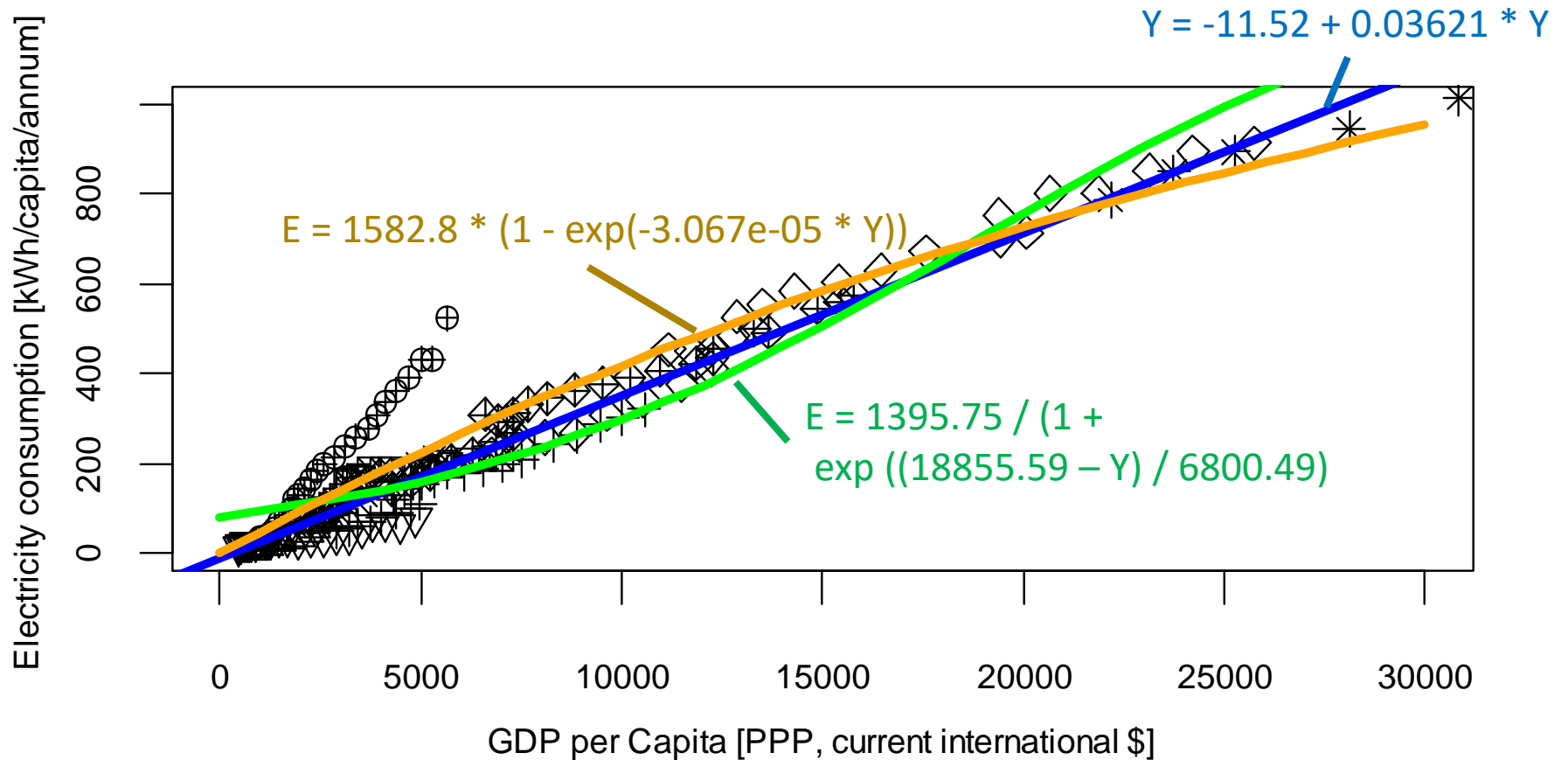
E_t : per capita residential electricity consumption at the t -year

I_t : the per capita income at the t -year

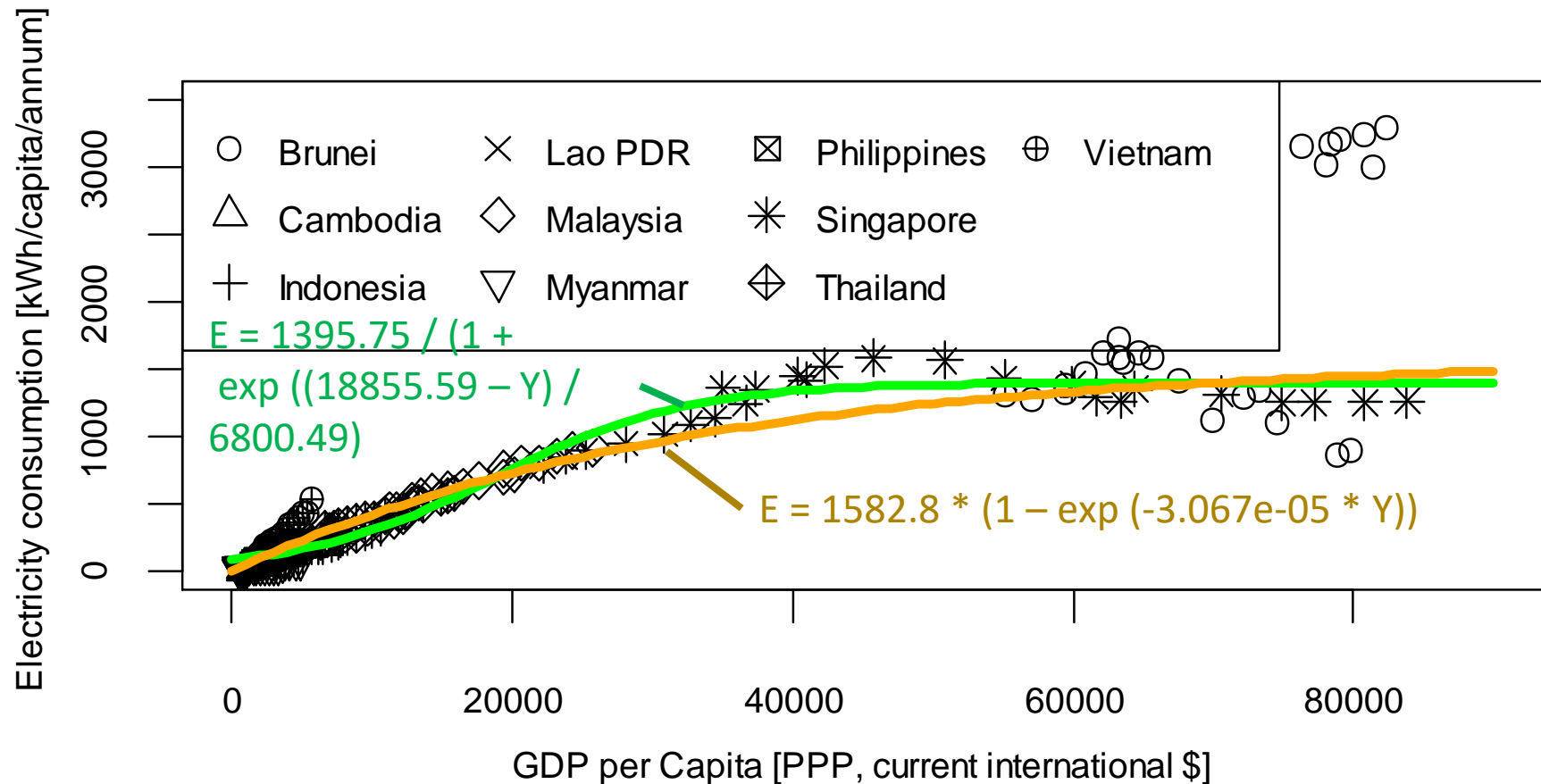
k_1 : asymptotic value of E_t

k_2 : parameter that depends by the electricity price and saturation impedance of electricity service

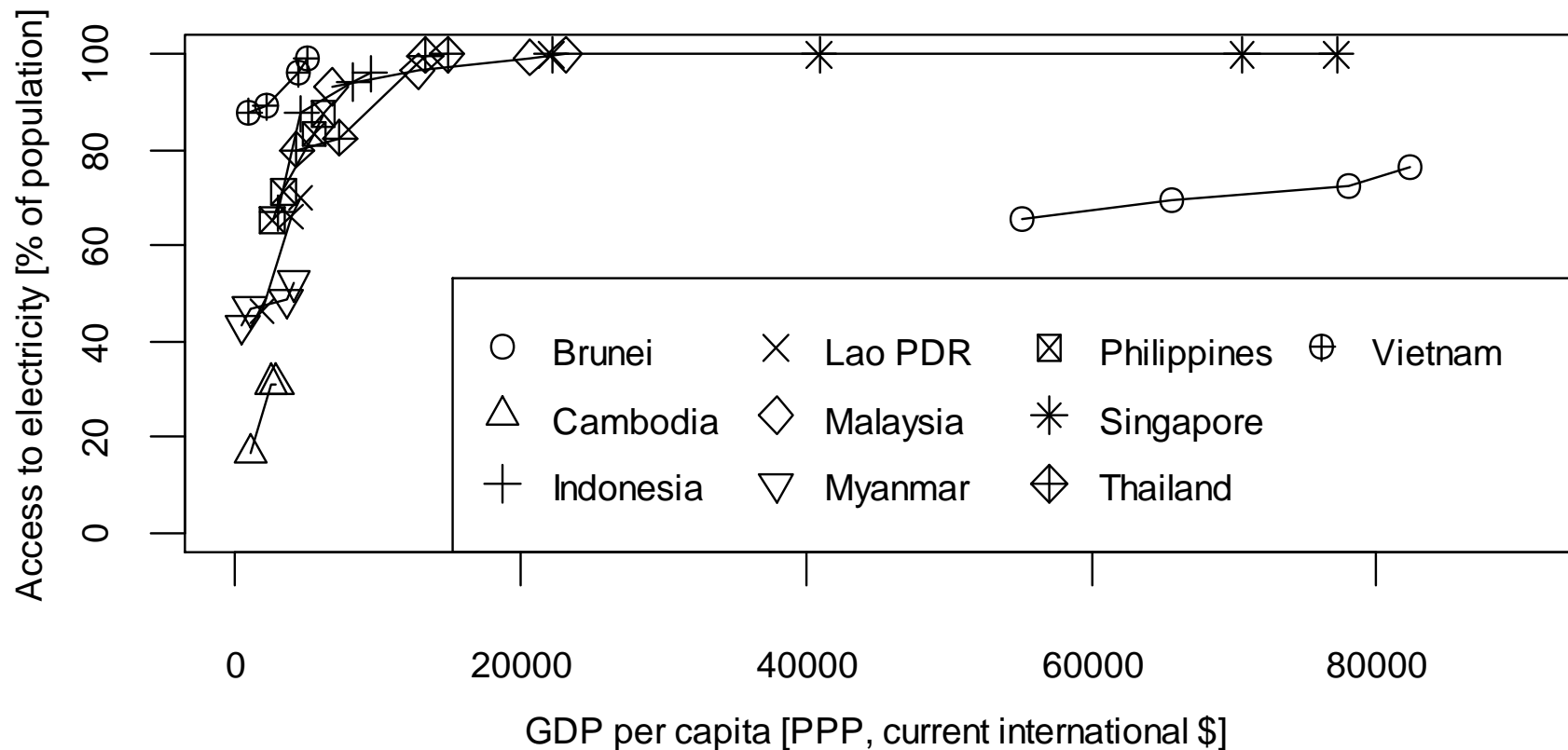
Regression curves



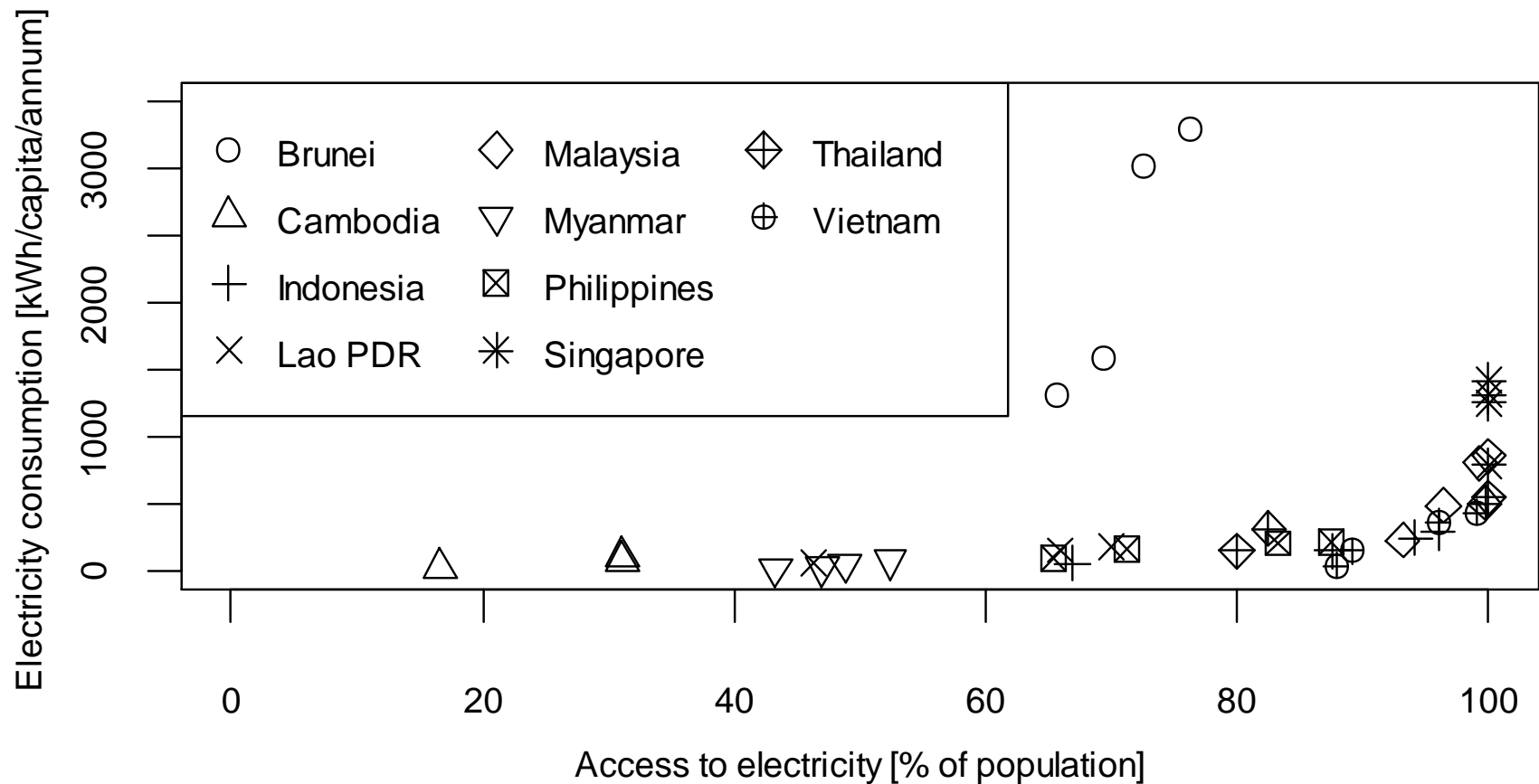
Regression curves



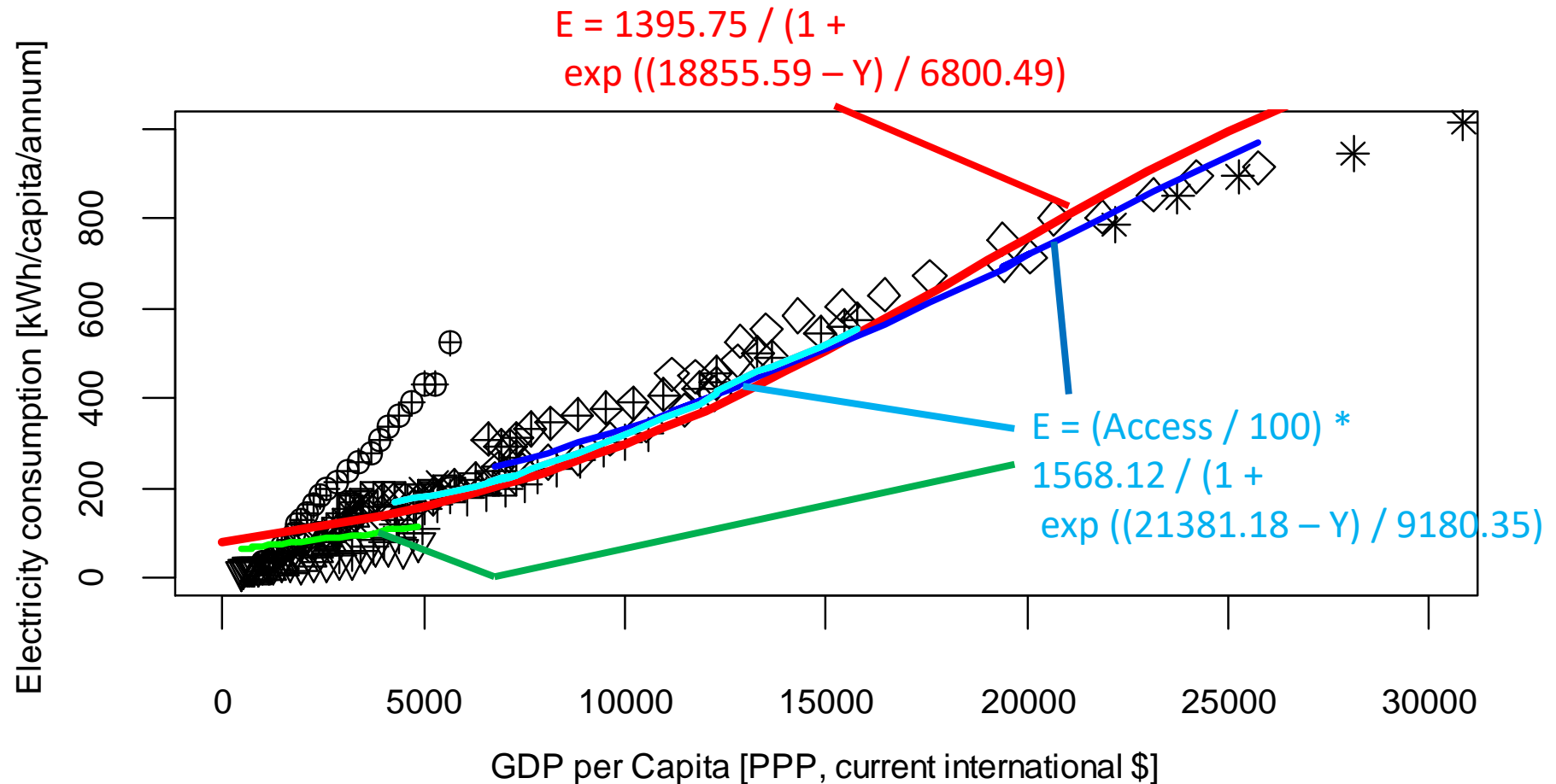
Per capita GDP vs Access to electricity ('90, '00, '10, and '12)



Access to electricity vs electricity consumption ('90, '00, '10, and '12)



Considering the access to electricity



Collected data provided by a web site

ASEANを中心としたモンスーン地域のエネルギーに関する情報を提供します。

Monsoon Project

〒755-8611 山口県宇部市常盤台2-16-1 福代研究室

TOP PAGE

ASEAN

Brunei

Cambodia

Indonesia

Laos

Energy Consumption in the ASEAN

Overview

Total and residential energy consumption in the member countries of the Association of Southeast Asian Nations (ASEAN) have increased by 112 and 52 percent respectively between 1990 and 2014 according to the statistics by the International Energy Agency (IEA) [1] and the United Nation Statistics Division (UNSD) [2]. In the same period, the total and residential energy consumption in the Organisation for Economic Co-operation and Development (OECD) countries have increased by only 17 and 15 percent respectively.

This rapid increase in the ASEAN's energy consumption is reportedly driven by the socio-economic development in the ASEAN countries. The IEA predicted that the ASEAN's energy demand will grow by 80%

<http://ds0.cc.yamaguchi-u.ac.jp/~fukuyo/ASEANEnergy/asean.html>